Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector Technology

Participant
Otter Tail Power Company

Additional Team Members
Montana-Dakota Utilities—co-host

NorthWestern Public Service—co-host

W.L. Gore & Associates, Inc.—licensee and filter bag provider

Energy and Environmental Research Center (University of North Dakota)—concept developer

Location
Big Stone City, Grant County, SD (Montana-Dakota Utilities and NorthWestern Public Service's Big Stone Power Plant)

Technology
Advanced Hybrid Particulate Collector

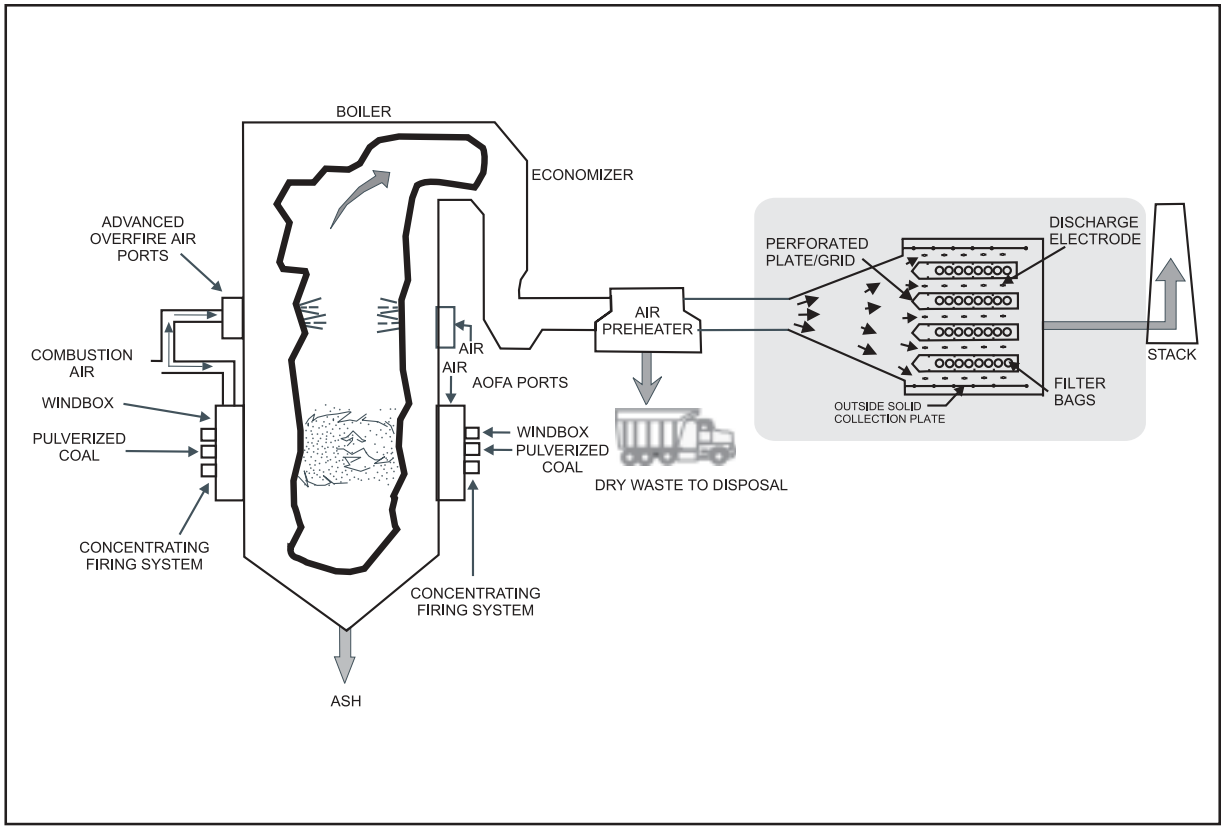
Plant Capacity/Production
450 MW

Coal
Low-sulfur coal

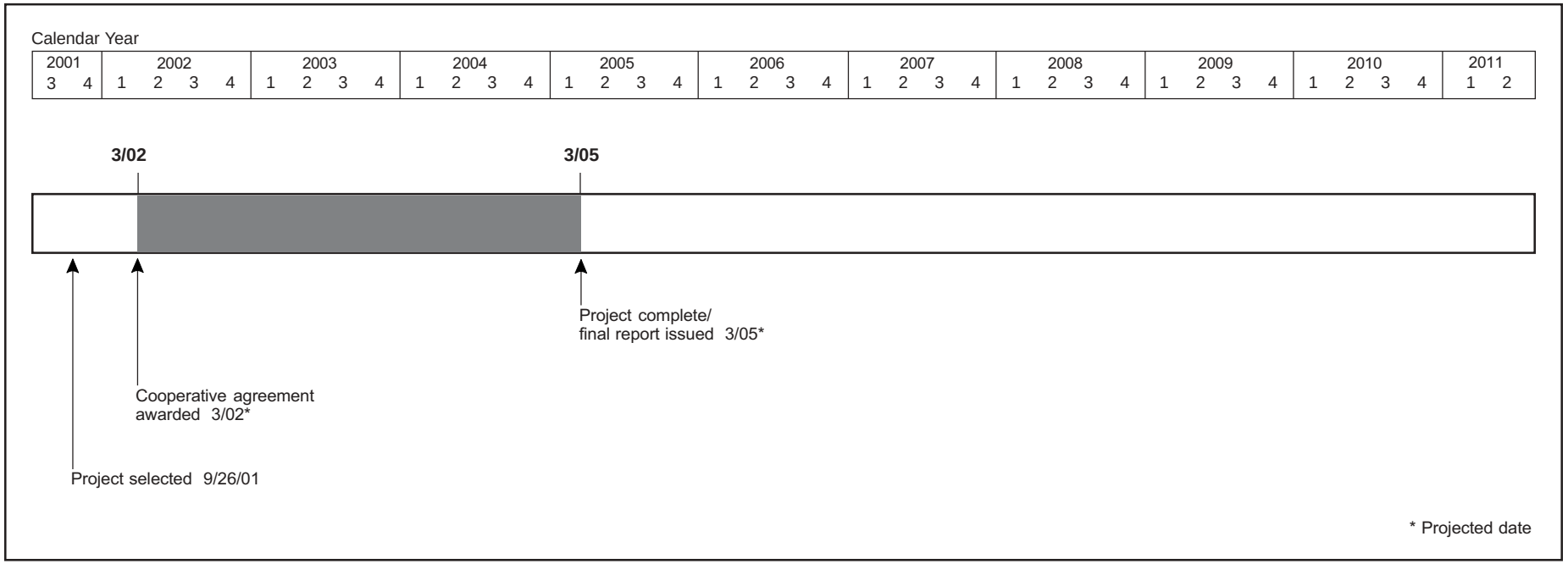
Project Funding

Total Project Cost	$13,397,445
DOE	6,491,000
Participant	6,906,445

Project Objective
To demonstrate, in a full-scale application, a hybrid technology that raises the particulate matter capture of coal plants up to 99.99% by integrating fabric filtration and electrostatic precipitation (ESP) in a single unit. The Advanced Hybrid Particulate Collector (AHPC) overcomes the problem of excessive fine particle emissions that escape collection in ESPs and the reentrainment of dust in baghouses. The overall goal of the project is to demonstrate the AHPC concept in a full-scale application. Specific objectives are to demonstrate ultra-low fine particulate emissions, low pressure drop, overall reliability of the technology and, eventually, long-term bag life.



Technology/Project Description
The AHPC combines the best features of ESPs and baghouses in an entirely novel manner. The AHPC concept combines fabric filtration and electrostatic precipitation in the same housing, providing major synergism between the two methods, both in the particulate collection step and in transfer of dust to the hopper. The AHPC provides ultra-high collection efficiency, overcoming the problem of excessive fine-particle emissions with conventional ESPs, and solves the problem of reentrainment and re-collection of dust in conventional baghouses.



Project Status/Accomplishments

The project was selected for award on September 26, 2001. Contract negotiations are under way as of the end of fiscal year 2001.

A slipstream AHPC (9,000 scfm) has been operating at the Big Stone Power Plant for the past one and one-half years. The AHPC demonstrated ultra-high particulate collection efficiency for submicron particles and total particulate mass. Collection efficiency was proven to exceed 99.99% by one to two orders of magnitude over the entire range of particles from 0.01 to 50 µm. The flue gas exiting the AHPC was as clean as pristine ambient air with a fine particulate matter level of 5 $\mu g/m^3$. This level of control would be well below any current particulate emission standards. These results were achieved while operating at significantly higher air-to-cloth ratios (12 ft/min compared to 4 ft/min) than what is used for standard pulse-jet baghouses. In fact, preliminary economic analysis of the AHPC compared with conventional ESPs and baghouses indicates that the AHPC is economically competitive with either of these technologies for meeting current standards. For meeting a possible stricter fine-particle standard or 99.99% control of total particulates, the AHPC is the economic choice over either ESPs or baghouses by a wide margin.

Commercial Applications

With new requirements to control respirable particulate matter (less than 2.5 microns in diameter; $PM_{2.5}$), the AHPC is a superior technology not only for new installations but as a retrofit technology as well. The AHPC combines a high particulate collection efficiency, with a small footprint and potential economic advantages. Given the age and performance level of many existing ESPs, there is a great and immediate need for this type of retrofit technology. This technology has potential application to all of the more than 1,000 coal-fired units. However, space and other site-specific constraints come in to play to preclude 100% applicability.